

## *PINS Supports Chemical Weapons Clean-up in Utah*

*The U.S. Army has used the portable isotopic neutron spectroscopy system since 1993 when the Army's Project Manager for Non-Stockpile Chemical Materiel employed PINS to identify the contents of World War I munitions discovered in Washington, D.C. Since that time, PM-NSCM continues to support further PINS research and development. This article reports on an unexpected application of the award-winning technology.*

The U.S. Army Deseret Chemical Depot, near Tooele, Utah, is in the process of destroying its stockpile of chemical warfare agents, as required by the 1993 Chemical Weapons Convention. The incineration process used to destroy these agents is heavily regulated and monitored closely by the U.S. Army and state agencies. During a trial burn of the chemical agents, traces of mercury were detected, which – if continued – would be inconsistent with their air permits. Further investigation correlated the mercury contamination with the large ton containers used to store bulk sarin, a nerve agent.

But which containers? Direct sampling is time-consuming, extremely costly, not simple, and possibly dangerous. Even in small amounts and diluted, sarin remains extremely hazardous. To meet the deadlines imposed by the Convention, Deseret Chemical Depot needed to continue destroying the contents of containers that contained no mercury.

Enter PINS. The Army had used the portable isotopic neutron spectroscopy system for years to identify the contents of suspect chemical munitions – without breaching the container. Could PINS, they wondered, identify trace amounts of mercury in these large tanks containing the sarin? They asked PINS developer Gus Caffrey to test the system.

"We had to make some changes in our process for several reasons," said Caffrey. "We were looking for small quantities in large containers. We didn't want to miss anything."

Knowing that mercury was 10 times more dense than the nerve agent, Caffrey had a hunch that the mercury, if present, would



*The PINS technology was adapted to detect small quantities of mercury at the bottom of large nerve gas containers (top and right). The team includes from left to right (front row) Bob Gehrke (ret.), Gus Caffrey and Ann Egger; (back row) Steve Frickey, Ken Krebs, Larry Blackwood, Andy Edwards and Ed Seabury. Not pictured are John Zabriskie, John Baker and Cathy Riddle.*

pool at the bottom of each ton container. INEEL mechanical engineer John Zabriskie designed a special version of the PINS stand, that allowed the instrument to look upward, inspecting the bottom of each container. To meet the Army's window for the measurements, mechanical design and fabrication of the stands took just one week. Jimmy Johnson, Dennis Mechling, and Woody Russell built the stands at the R&D Prototype Engineering Lab.



In the autumn of 2000, the PINS team tested 10 percent of the sarin-filled containers and reported their results. Independent tests confirmed their accuracy and the Army now had a safe method to identify the correct tanks for continued incineration. The Army asked Caffrey to complete assessment of the remaining ton container inventory during the following summer.

Surveying the remaining 90 percent could take a long time. The PINS team had to find methods to speed the process, yet maintain accuracy. During the initial test, they assayed each ton container for 2000 seconds. For this year's effort, if they detected mercury at 500 seconds, they would stop. If no mercury was evident at 500 seconds, they would continue to 1000 seconds.

To insure adequate sensitivity with the reduced assay times, PINS was tested against known quantities of mercury in an experiment conducted at the Test Reactor Area. An actual ton container was used and filled with water to simulate the nerve agent. Statistician Larry Blackwood tallied up the experimental results

and calculated the minimum detectable mass of mercury as 2.1 grams.

"We found we could detect a couple of grams of mercury in almost a ton of nerve agent," said Caffrey. "Our three parts-per-million mercury detection level easily met the Army needs."

The supporting spreadsheets and graphical data fill 10 three-inch notebooks. The state is satisfied and Deseret Chemical Depot quickly began incineration of the sarin agent in the non-contaminated ton containers. The agent from the contaminated ton containers was chemically processed to remove the mercury,

checked for residual contamination by X-ray fluorescence, and then incinerated. All of the sarin nerve agent at Deseret Chemical Depot has now been destroyed.

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## Achievements, Accomplishments, Acknowledgements

**N**eed to Know received a 2002 Apex Award for Publication Excellence. Nominations are selected "based on excellence in graphic design, editorial content and the success of the entry – in the opinion of the judges – in achieving overall communication effectiveness and excellence." This was the first year the National Security newsletter was submitted for consideration.

Mike Occhionero and Julio Rodriguez regularly travel to area schools to talk about robots and engineering. They encourage and inspire students to consider the opportunities in science and math. Recently, they ran a Packbot robot named Bunsen through its paces to the delight of second-graders at Templeview Elementary School. Students showed their gratitude with an outpouring of letters and drawings.

Roberta Jordan received a master's degree in chemistry from the University of Idaho. Jordan earned the degree while working full-time and continuing her outstanding support for the community. She had received the INEEL President's Special Achievement Award in 2000 for her community work.

Sherry Gallup was recognized as 2001-2002 Member of the Year for the Eagle Rock Chapter of the International Association of Administrative Professionals. Gallup has served as president of the Eagle Rock chapter in 2000-2001, secretary for the Idaho-

Oregon-Utah Division in 2001-2002, and effective July 1, will serve as president-elect for the Division during 2002-2003. She has represented the chapter at international conferences.

The Director of Information and Special Technologies Programs for the U.S. Department of Energy's Office of Counterintelligence wrote to INEEL Counterintelligence Program Manager Jack Way, "Please pass along my appreciation and thanks to Bonnie (Hong) and Brett (Rasmussen). They have strapped on a very difficult project and are succeeding. The project is not only on track and under budget, but all the feedback I received has reinforced the fact that your staff has been professional, personable and accommodating at each site. It is always a pleasure to work with you and your folks at INEEL."

Dennis Bingham received a patent for "Apparatus for Pumping Liquids at or Below the Boiling Point."

John Grandy received a patent on "Methods of Chemically Converting First Materials to Second Materials Utilizing Hybrid-Plasma Systems."

Ben Perrenoud, Herschel Smartt, Eric Larsen, Rodney Bitsoi, Karen Miller and David Pace received a patent on "Apparatus for the Concurrent Inspection of Partially Completed Welds."

(Clockwise from right) Sherry Gallup was recognized as 2001-2002 Member of the Year for the Eagle Rock Chapter of the International Association of Administrative Professionals. Julio Rodriguez demonstrates a Packbot robot to children at Templeview Elementary School. INEEL's **Need to Know** newsletter won a 2002 Apex Award for Publication Excellence.



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